

Appl. No. 09/590,657  
59.0027

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. Previously cancelled.
2. (Previously amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes, wherein the adaptive far-end cross-talk cancellation logic comprises

a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on a first propagation mode and having logic to direct the processor to accept samples from a second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode; and further comprises instructions to cause the processor to

Appl. No. 09/590,657  
59.0027

determine a slice residual from the output of the cross-talk  
adjustment logic; and  
update a cross-talk parameter from the slice residual.

3. Previously Cancelled.

4. (Previously Amended): The digital telemetry system of Claim 2, wherein the far-end adaptive cross-talk cancellation logic causes the processor to accept as input one value on each of a plurality of carriers and to compute the cross-talk component for each carrier.

5. (Previously Amended): The digital telemetry system of Claim 4, wherein the far-end adaptive cross-talk cancellation logic directs the processor to compute the cross-talk component for each carrier by multiplying the signal received on the second propagation mode by a carrier specific coefficient.

6. (Currently Amended): The digital telemetry system of Claim 5, wherein the a far-end cross-talk parameter update logic directs the processor to update each carrier specific coefficient as a function of the slice residual on such carrier.

7. (Previously Amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

Appl. No. 09/590,657  
59.0027

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes,

wherein the adaptive far-end cross-talk cancellation logic comprises a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on a first propagation mode and having logic to direct the processor to accept samples from a second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode, and

further wherein the far-end adaptive cross-talk cancellation logic causes the processor to accept as input one value on each of a plurality of carriers and to compute the cross-talk component for each carrier by multiplying the signal received on the second propagation mode by a carrier specific coefficient and to update each carrier specific coefficient by applying the equation:

$$CXY_i = CXY_i + \text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < \text{TXFFT\_out}[i], \text{TYresidual}[i] >$$

where

$CEX_i$  is the frequency domain equalizer coefficient for the  $i$ th carrier of propagation mode  $X$ ;

$CXY_i$  is the cross-talk cancellation coefficient for the  $i$ th carrier for cancelling far-end cross-talk from propagation mode  $X$  to propagation mode  $Y$ ;

$\text{AlphaFEXT}$  is a constant for balancing the tracking speed of  $CXY_i$  against the stability of the value of  $CXY_i$ ;

Appl. No. 09/590,657  
59.0027

REF\_MAGN is the Root Means Square (RMS) magnitude of the reference data points;

TXFFT\_out[i] is the frequency domain data point on the ith carrier on propagation mode X;

TYresidual[i] is the slice residual for the ith data point on the Y propagation mode; and

$\langle \rangle$  is the complex scalar product.

8. (Previously Amended): The digital telemetry system of Claim 2, wherein the far-end cross-talk adjustment logic directs the processor to receive  $m$  samples from the second propagation mode and convolve these using  $m$  coefficients.

9. (Previously Amended): The digital telemetry system of Claim 8, wherein the storage medium further stores instructions comprising a slice determination logic and a coefficient update logic directing the processor to adjust the  $m$  coefficients as a function of a slice residual determined by the slice determination logic.

10. (Previously amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

Appl. No. 09/590,657  
59.0027

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes, the adaptive far-end cross-talk cancellation logic comprising a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on a first propagation mode and having logic to direct the processor to accept samples from a second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode,

wherein the far-end cross-talk adjustment logic directs the processor to receive  $m$  samples from the second propagation mode and convolve these using  $m$  coefficients and the storage medium further stores instructions comprising a slice determination logic and a coefficient update logic directing the processor to adjust the  $m$  coefficients as a function of a slice residual determined by the slice determination logic using the equation:

$$CXY_i = CXY_i + \text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < TY_{(n-i)}, TX_{\text{residual}} > \quad \text{where,}$$

$CEX_i$  is the  $i$ th time domain equalizer coefficient of propagation mode X;

$CXY_i$  is the  $i$ th cross-talk cancellation coefficient for canceling far-end cross-talk from propagation mode X onto propagation mode Y;

$TY_j$  is the  $j$ th sample from the second receive circuitry coefficient of propagation mode Y;

$TX_{\text{Residual}}$  is  $TX_{\text{Corr}} - TX_{\text{IdealPoint}}$

where  $TX_{\text{Corr}}$  is the cross-talk corrected output from the cross-talk adjustment circuit and  $TX_{\text{IdealPoint}}$  is an ideal constellation point for propagation mode X; and

$\text{AlphaFEXT}$  is a constant between 1 and 0; and

$< >$  is the complex scalar product.

Appl. No. 09/590,657  
59.0027

11. (original): The digital telemetry system of Claim 10, wherein AlphaFEXT is in the range 0.001 to 0.00001.

12. Cancelled.

13. Cancelled.

14. Cancelled.

15. (Previously amended) A method of digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first sample received on a first propagation mode;

inputting a second sample received on a second propagation mode;

determining the slice residual;

determining a cross-talk component from the second sample on the first sample ;

adjusting a function used to determine the cross-talk component as a function of the slice residual; and

determining an output by subtracting the cross-talk component from the second sample from the first sample, wherein the cross-talk component is determined by multiplying a carrier specific coefficient with a sample received on a corresponding carrier on the near-lying propagation mode and the coefficients are updated by applying the function:

$$CXY_i = CXY_i +$$
$$\text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < \text{TXFFT\_out}[i], \text{TYresidual}[i] >$$

Appl. No. 09/590,657  
59.0027

where

CEX<sub>i</sub> is the frequency domain equalizer carrier for i<sup>th</sup> carrier of propagation mode X;

CXY<sub>i</sub> is the cross-talk cancellation coefficient for the i<sup>th</sup> carrier for canceling far-end cross-talk from propagation mode X to propagation mode Y;

AlphaFEXT is a constant for balancing the tracking speed of CXY<sub>i</sub> against the stability of the value of CXY<sub>i</sub>;

REF\_MAGN is the RMS magnitude of the reference data points;

TXFFT\_out[i] is the frequency domain data point on the i<sup>th</sup> carrier of propagation mode X;

TYresidual[i] is the slice residual for the i<sup>th</sup> data point on the Y propagation mode; and

< > is the complex scalar product.

16. Cancelled.

17. Cancelled.

18. Cancelled.

19. (Previously amended) A method of digital telemetry having improved data rate or robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first set of samples received on a first propagation mode;

inputting a second set of samples received on a second propagation mode;

determining a cross-talk component by convolving the second set of samples, convolving comprising multiplying each sample in the second set of samples by a coefficient;

determining an output by subtracting the cross-talk component from a first sample on the first propagation mode;

Appl. No. 09/590,657  
59.0027

determining a slice residual between the output and an ideal point; and  
adjusting the coefficients as a function of the slice residual by applying the  
equation:

$$CXY_i = CXY_i + \text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < TY_{(n-i)}, TX_{\text{residual}} > \quad \text{where,}$$

$CEX_i$  is the  $i$ th time domain equalizer coefficient for propagation mode X;

$TY_j$  is the  $j$ th sample from the second receive circuitry of propagation  
mode Y;

$TX_{\text{Residual}}$  is  $TX_{\text{Corr}} - TX_{\text{IdealPoint}}$

where  $TX_{\text{Corr}}$  is the cross-talk corrected output from the cross-talk  
adjustment circuit and  $TX_{\text{IdealPoint}}$  is an ideal constellation point for propagation  
mode X; and

AlphaFEXT is a constant between 1 and 0; and

$< >$  is the complex scalar product.

20. (Currently amended): The method of Claim 19 wherein AlphFEXT is in the range  
0.001 to 0.00001 ~~0.0001~~.